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State-level geographic variation in prompt access to care for children after motor vehicle crashes

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ABSTRACT

Background: Motor vehicle crashes (MVCs) are a principal cause of death in children; fatal MVCs and pediatric trauma resources vary by state. We sought to examine state-level variability in and predictors of prompt access to care for children in MVCs.

Materials and methods: Using the 2010-2014 Fatality Analysis Reporting System, we identified passengers aged <15 y involved in fatal MVCs (crashes on US public roads with ≥ 1 death, adult or pediatric, within 30 d). We included children requiring transport for medical care from the crash scene with documented time of hospital arrival. Our primary outcome was transport time to first hospital, defined as >1 or ≤ 1 h. We used multivariable logistic regression to establish state-level variability in the percentage of children with transport time >1 h, adjusting for injury severity (no injury, possible injury, suspected minor injury, suspected severe injury, fatal injury, and unknown severity), mode of transport (emergency medical services [EMS] air, EMS ground, and non-EMS), and rural roads.

Results: We identified 18,116 children involved in fatal MVCs from 2010 to 2014; 10,407 (57%) required transport for medical care. Median transport time was 1 h (interquartile range: [1, 1]; range: [0, 23]). The percent of children with transport time >1 h varied significantly by state, from 0% in several states to 69% in New Mexico. Children with no injuries identified at the scene and crashes on rural roads were more likely to have transport times >1 h.

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Conclusions: Transport times for children after fatal MVCs varied substantially across states. These results may inform state-level pediatric trauma response planning.

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Introduction

Unintentional injury and, specifically, motor vehicle crashes (MVCs), are a substantial source of pediatric mortality in the United States.¹ Prompt access to medical care after an MVC has been shown to be associated with improved outcomes, with prior studies demonstrating that arrival at definitive care within 1 h of injury is associated with decreased mortality as well as decreased length of hospital stay.^{2,3} MVC-related mortality in children has been shown to vary by state, with age-adjusted mortality rates per 100,000 children varying from 0.25 in Massachusetts to 3.23 in Mississippi.⁴ Trauma response services are coordinated at the state level, and there is known variability in available resources by state, with some states having funded trauma systems, others having nonfunded trauma systems, and some having no state-supported trauma system.⁵

In addition, the availability of pediatric-specific trauma resources varies by state, with many states having multiple verified pediatric trauma centers and many having none.⁶ Although there is debate over the value of dedicated pediatric trauma centers,⁷⁻⁹ there is evidence that treatment at these centers is associated with lower mortality rates.¹⁰⁻¹² Furthermore, there is often geographic separation between pediatric trauma resources, as these facilities tend to be located in metropolitan areas.⁶ Given the state-based variability in pediatric mortality after MVCs and the state-based variability in trauma resources, we hypothesized that differences in timely access to care may drive differences in pediatric mortality after MVCs. We sought to understand first, the consistency of documentation of emergency medical services (EMSs) hospital arrival times in a large national dataset; second, the variability in transport time >1 h from the scene of a crash to arrival

at the first hospital by state in which the crash occurred; and third, state-level predictors of each of these outcomes.

Methods

Data source

We used the 2010-2014 Fatality Analysis Reporting System (FARS), a nationwide census maintained by the National Highway Traffic Safety Administration that provides publicly available data on fatalities associated with MVCs. The FARS included all fatal crashes in the United States, defined as crashes that occur on a public road and result in ≥ 1 death (adult or pediatric) within 30 d. The dataset contained information on the time of each crash, the time of EMS arrival, and the time of arrival at the first medical facility, in addition to information on injury severity as assessed by EMS, mode of transport, and location of the crash.¹³ State-level variables were compiled from additional sources, including the American College of Surgeons (ACS),¹⁴ the US Census,¹⁵ and the medical literature.⁵

Study sample

We included children aged <15 y riding in a passenger vehicle involved in a fatal crash who required transport to a hospital for medical evaluation (Fig. 1). Passenger vehicles were defined by the National Highway Traffic Safety Administration as cars, sport utility vehicles, vans, and pickup trucks with a gross weight $\leq 10,000$ pounds.^{13,16} We excluded children classified as drivers, passengers on a motorcycle/bicycle, or pedestrians, as well as children in an unenclosed passenger or cargo area, the vehicle exterior, or

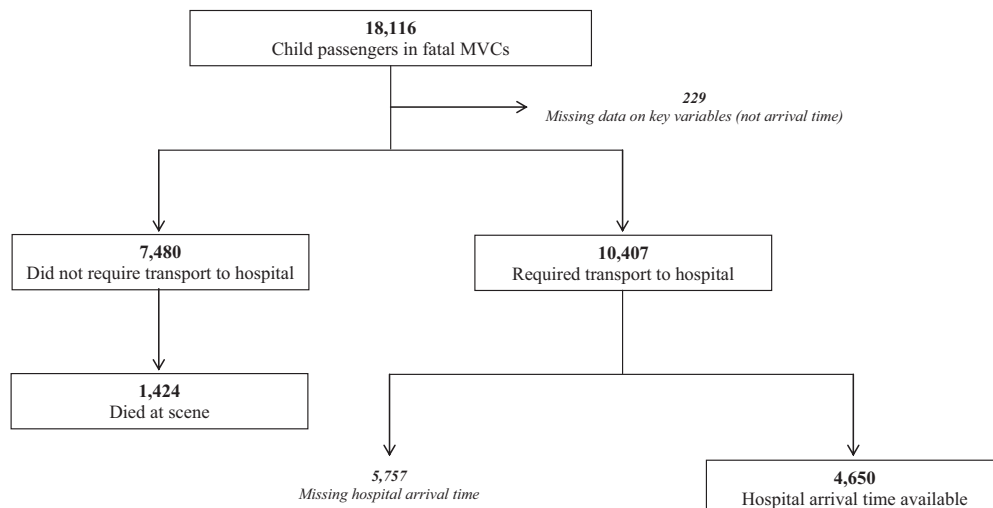


Fig. 1 – Study population.

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